

H02M

APPARATUS FOR CONVERSION BETWEEN AC AND AC, BETWEEN AC AND DC, OR BETWEEN DC AND DC, AND FOR USE WITH MAINS OR SIMILAR POWER SUPPLY SYSTEMS; CONVERSION OF DC OR AC INPUT POWER INTO SURGE OUTPUT POWER; CONTROL OR REGULATION THEREOF (systems for regulating electric or magnetic variables in general, e.g. using transformers, reactors or choke coils, combination of such systems with static converters [G05F](#); {digital function or clock generators} for digital computers [G06F 1/00](#), {[G06F 1/025](#), [G06F 1/04](#)}; transformers [H01F](#); connection or control of one converter with regard to conjoint operation with a similar or other source of supply [H02J](#); dynamo-electric converters [H02K 47/00](#); controlling transformers, reactors or choke coils, control or regulation of electric motors, generators or dynamo-electric converters [H02P](#); pulse generators [H03K](#); {static converters specially adapted for igniting or operating discharge lamps [H05B 41/28](#)})

Definition statement

This place covers:

- Generic details relating to switch mode power (chopper-type) converters;
- Circuits performing DC to DC power conversion other than by linear regulation;
- Circuits performing AC to AC power conversion by direct conversion without a DC link;
- Circuits performing AC to AC power conversion by initial conversion of AC into DC, using a DC-link, and subsequent conversion from DC back to AC;
- Circuits performing AC to DC power conversion with actively switched or passively controlled rectification elements;
- Circuits performing DC to AC power conversion with static operation, i.e. without physical movement.
- Circuits performing power conversion with dynamic operation, i.e. involving physical movement.

Relationships with other classification places

This subclass covers only circuits or apparatus for the conversion of electric power, or arrangements for control or regulation of such circuits or apparatus. The electrotechnical elements employed are dealt within the appropriate subclasses, e.g. inductors, transformers [H01F](#), capacitors, electrolytic rectifiers [H01G](#), mercury rectifying or other discharge tubes [H01J](#), semiconductor devices [H01L](#), impedance networks or resonant circuit not primarily concerned with the transfer of electric power [H03H](#).

Voltage and current regulation circuits operating according to the non-switched (linear) principle are classified in subclass [G05F](#)

The subject matter of starting, regulating, electronically commutating, braking, or otherwise controlling electrical machines using power converters covered by this subclass is classified in subclass [H02P](#).

Arrangements of power converters of this subclass in power distribution networks, not being concerned with the particular converter designs, are classified in subclass [H02J](#).

Measuring of circuit parameters such as currents, voltages or magnetic flux in general and not particularly intended for power converters of this subclass, is classified in subclass [G01R](#).

General mechanical arrangements of electronic components other than mechanical arrangements particularly intended for power converters of this subclass, are classified in subclass [H05K](#).

Protection circuits in general, other than those forming an integral part of power converters of this subclass are classified in subclass [H02H](#)

Enabling and disabling of power switches, other than particularly intended for power switches in power converters of this subclass, is classified in subclass [H03K](#).

Use and generation of Pulse Width Modulation schemes, other than particularly intended for power converters of this subclass, are classified in subclass [H03K](#)

General testing and monitoring of power converters of this subclass are classified in subclass [G01R](#)

Power converters particularly adapted for charging batteries are classified in subclass [H02J](#).

Uninterruptible Power Supplies are classified in subclass [H02J](#)

Dynamically controlled power converters, that serve the purpose of signal amplification rather than energy supply as in this subclass, are classified in [H03F](#)

Power supply circuits particularly intended for operating light sources are classified in subclass [H05B](#)

Power supply circuits and arrangements particularly intended for computer type gear are classified in subclass [G06F](#)

Power supply circuits and arrangements particularly intended for video type gear are classified in subclass [H04N](#)

Switched capacitor power conversion circuits particularly intended for supply of semiconductor memory circuits are classified in subclass [G11C](#)

Generation of pulsed high-voltages used to generate sparks is classified in [H01T/F23Q/F02P](#)

Power converters being used in a particular application and characterised by their operation in that application, without focus on the design of power converter, are classified in the subclass relevant for the application.

References

Limiting references

This place does not cover:

Linear voltage or current regulation	G05F 1/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Testing power supplies	G01R 31/40 , G01R 31/42
Emergency protective circuit arrangements...for static converters or rectifiers	H02H 7/12
Electronic switching or gating	H03K 17/00
Generation or supply of power specially adapted for television receivers	H04N 5/63

Special rules of classification

Switch Mode Power Converters are generally made up of generic, functional elements. Such generic elements are rectifiers (AC-DC-conversion), inverters (DC-AC-conversion), transformers (AC-AC-conversion), filters, regulation loops, resonance-circuits, drivers, snubbers etc. Of these generic elements only few may appear at first glance to be novel over the prior art and it serves no purpose repeatedly to classify all elements. Only those elements that appear novel should form basis for the classification.

The following IPC groups are not used in the internal ECLA classification scheme. Subject matter covered by these groups is classified in the following ECLA groups :

- **H02M9/00** covered by [H03K 3/53](#)
- **H02M9/02** covered by [H03K 3/53](#)
- **H02M9/04** covered by [H03K 3/53](#)
- **H02M9/06** covered by [H03K 3/53](#)

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

SMPS	Switch Mode Power Supply. A general designation for the type of power converters where power is converted in small quantities at a very rapid pace. The energy entering into the conversion circuit or out of the conversion circuit is controlled by power switches. In an SMPS the power switches are typically operated either to be fully conducting or fully non-conducting, opposite to linear voltage regulators where the power switch is used as partly conductive.
Chopper	Chopper is another name for a switch mode circuit. Chopper refers to that the signal (energy flow) is cut-up into small amounts.
"Conversion", in respect of an electric variable, e.g. voltage or current	change of one or more of the parameters of the variable, e.g. amplitude, frequency, phase, polarity
PFC	Power Factor Correction. PFC relates to AC power input. Power Factor Correction is the discipline of rendering the input current sine-wave-shaped, with little harmonics and in phase with the AC input voltage. The aim is to make the AC input power load appear purely resistive for efficient use of the AC distribution network.
Snubber	A circuit aiming at absorbing or redirecting inductive energy generated during switched power conversion when a power switch is turned off (rendered non-conductive).

H02M 1/00

Details of apparatus for conversion

Definition statement

This place covers:

- Details of power converters that are generic for different types of power converters.
- Power switch driving circuits particularly intended for switch mode power converters.
- Adaptation of power converters for operation from different kind of input sources.
- Means for reducing ripple or harmonics on inputs or outputs.
- Contact mechanisms of dynamic converters.
- Means for protecting power converters.
- Means for starting and stopping power converters.
- Means for preventing simultaneous conduction of switches.
- Means for preventing magnetic saturation.
- Circuits or arrangements for Power Factor Correction.
- Circuits or arrangements for compensating for electromagnetic interference.

References

Limiting references

This place does not cover:

Protection circuits in general, other than those forming an integral part of power converters	H02H 7/10 , H02H 7/12
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Protection circuits in general	H02H
Electronic switching or gating	H03K 17/00

H02M 1/096

the power supply of the control circuit being connected in parallel to the main switching element ([H02M 1/092](#) takes precedence)

References

Limiting references

This place does not cover:

Control signals being transmitted optically	H02M 1/092
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H02M 1/32

Means for protecting converters other than automatic disconnection (emergency protective circuit arrangements specially adapted for converters with automatic disconnection [H02H 7/10](#))

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Emergency protective circuit arrangements specially adapted for converters with automatic disconnection	H02H 7/10
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H02M 3/00

Conversion of dc power input into dc power output {(converters specially adapted for use in combination with a battery [H02J 7/0065](#))}

Definition statement

This place covers:

- Conversion of DC power input into DC power output without conversion into AC.
- Conversion of DC power input into DC power output with conversion into AC.
- Conversion of DC power input into DC power output using dynamic converters.

References

Limiting references

This place does not cover:

Converters specially adapted to charge batteries	H02J 7/0065
Electric motor control with feedback of internal parameters of the motor	H02P

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protection circuits in general	H02H
Electronic switching or gating	H03K 17/00
Generation or supply of power specially adapted for television receivers	H04N 5/63

H02M 3/07

using capacitors charged and discharged alternately by semiconductor devices with control electrode, {e.g. charge pumps (for substrate bias voltage generators [G05F 3/205](#); for static stores [G11C 5/145](#), [G11C 16/06](#); charge pumping structures for internal polarisation [H01L 27/0222](#))}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Charge pumps for substrate bias voltage generators	G05F 3/205
Charge pumps for static stores	G11C 5/145 , G11C 16/06
Charge pumping structures for internal polarisation	H01L 27/0222

H02M 3/10

using discharge tubes with control electrode or semiconductor devices with control electrode ([H02M 3/07](#) takes precedence)

References

Limiting references

This place does not cover:

Capacitors charged and discharged alternately by semiconductor devices with control electrode	H02M 3/07
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H02M 3/337

in push-pull configuration {(H02M 3/33576 takes precedence; with self-oscillating arrangements H02M 3/3382 and H02M 3/3385)}

References

Limiting references

This place does not cover:

Semiconductor devices having at least one active switching element at the secondary side of an isolation transformer	H02M 3/33576
With self-oscillating arrangements	H02M 3/3382 , H02M 3/3385

H02M 3/338

in a self-oscillating arrangement (H02M 3/337 takes precedence)

References

Limiting references

This place does not cover:

Semiconductor devices in push-pull configuration	H02M 3/337
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H02M 3/42

with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general [H01H 51/34](#))

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Self-interrupters in general	H01H 51/34
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H02M 5/00

Conversion of ac power input into ac power output, e.g. for change of voltage, for change of frequency, for change of number of phases

Definition statement

This place covers:

- Direct conversion of AC input power into different AC output power, e.g. by change of voltage, frequency or number of phases, without intermediate conversion into DC.
- Conversion of AC input power into AC output power with intermediate conversion onto DC (DC-link).
- Conversion of AC input power into AC output power using dynamic conversion means.

References

Limiting references

This place does not cover:

Uninterruptible power supplies	H02J 9/00
Electric motor control with feedback of internal parameters of the motor	H02P

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protection circuits in general	H02H
Electronic switching or gating	H03K 17/00

H02M 5/04

by static converters (controlling transformers, reactors or choke coils, e.g. by tap changing [H02P 13/00](#))

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Controlling transformers, reactors or choke coils, e.g. by tap changing	H02P 13/00
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H02M 5/25

using devices of a thyatron or thyristor type requiring extinguishing means ({[H02M 5/225](#)}, [H02M 5/27](#) take precedence)

References

Limiting references

This place does not cover:

Two stages of AC-AC conversion, e.g. having a high frequency intermediate link	H02M 5/225
Conversion of frequency	H02M 5/27

H02M 5/275

using devices of a triode or transistor type requiring continuous application of a control signal ({[H02M 5/225](#)}, [H02M 5/297](#) take precedence)

References

Limiting references

This place does not cover:

Two stages of AC-AC conversion, e.g. having a high frequency intermediate link	H02M 5/225
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Conversion of frequency	H02M 5/297
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H02M 7/00

Conversion of ac power input into dc power output; Conversion of dc power input into ac power output

Definition statement

This place covers:

- Constructional details of power converters.
- Conversion of AC power input into DC power output without reversal.
- Conversion of DC power input into AC power output without reversal.
- Conversion of AC power input into DC power output or DC power input into AC power output with possibility of reversal.
- Conversion of AC power input into DC power output or DC power input into AC power output using dynamic converter means.

References

Limiting references

This place does not cover:

Electric motor control with feedback of internal parameters of the motor	H02P
Switched power amplifiers (class D)	H03F

Informative references

Attention is drawn to the following places, which may be of interest for search:

Semiconductor device modules	H01L
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H02M 7/23

arranged for operation in parallel {([H02M 7/2176](#) takes precedence)}

References

Limiting references

This place does not cover:

Semiconductor devices comprising a passive stage to generate a rectified sinusoidal voltage and a controlled switching element in series between such stage and the output	H02M 7/2176
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H02M 7/36

with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general [H01H 51/34](#))

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Self-interrupters in general	H01H 51/34
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H02M 7/505

using devices of a thyatron or thyristor type requiring extinguishing means {([H02M 7/4807](#), [H02M 7/483](#), [H02M 7/493](#) and [H02M 7/4826](#) take precedence)}

References**Limiting references**

This place does not cover:

High frequency intermediate AC stage	H02M 7/4807
Discharge tubes with control electrode or semiconductor devices with control electrode operating from a resonant DC source, i.e. the DC input voltage varies periodically, e.g. resonant DC-link inverters	H02M 7/4826

H02M 7/519

in a push-pull configuration ([H02M 7/517](#) takes precedence)

References**Limiting references**

This place does not cover:

Special starting equipment	H02M 7/517
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H02M 7/53

using devices of a triode or transistor type requiring continuous application of a control signal {([H02M 7/4807](#), [H02M 7/493](#) and [H02M 7/4826](#) take precedence)}

References**Limiting references**

This place does not cover:

High frequency intermediate AC stage	H02M 7/4807
Discharge tubes with control electrode or semiconductor devices with control electrode operating from a resonant DC source, i.e. the DC input voltage varies periodically, e.g. resonant DC-link inverters	H02M 7/4826

H02M 7/5383

in a self-oscillating arrangement ([H02M 7/538](#) takes precedence)

References**Limiting references**

This place does not cover:

In a push-pull configuration	H02M 7/538
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H02M 7/539

with automatic control of output wave form or frequency
([H02M 7/5375](#) - [H02M 7/5387](#) take precedence)

References**Limiting references**

This place does not cover:

Special starting equipment	H02M 7/5375
Push-pull configuration	H02M 7/538
Self-oscillating arrangement	H02M 7/5383
Bridge configuration	H02M 7/5387

H02M 7/62

with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general [H01H 51/34](#))

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Self-interrupters in general	H01H 51/34
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H02M 7/75

using devices of a thyatron or thyristor type requiring extinguishing means
([H02M 7/77](#) takes precedence)

References**Limiting references**

This place does not cover:

Devices of a thyatron or thyristor type arranged for operation in parallel	H02M 7/77
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H02M 7/79

using devices of a triode or transistor type requiring continuous application of a control signal ([H02M 7/81](#) takes precedence)

References**Limiting references**

This place does not cover:

Devices of a triode or transistor type arranged for operation in parallel	H02M 7/81
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H02M 7/95

with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general [H01H 51/34](#))

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Self-interrupters in general	H01H 51/34
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H02M 11/00

Power conversion systems not covered by the preceding groups

Definition statement

This place covers:

- Switch mode power converters not falling under any of the groups described previously.
- Power converters with pulsed power output.
- Power converters including piezo-electric elements performing power conversion.

References**Limiting references**

This place does not cover:

Generation of pulsed high-voltages used to generate sparks	H01T 15/00 , F23Q , F02P/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Piezo-electric devices	H01L 41/00
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